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M. Pollak, M. Ortuño and A. Frydman
Frontmatter
More information

THE ELECTRON GLASS

Presenting an up-to-date report on electron glasses, this book examines experiments and theories for a variety of disordered materials where electrons exhibit glassy properties. The authors examine problems in this field, highlighting which issues are currently understood and which require further research. Where appropriate, the authors focus on physical arguments over elaborate derivations. Some interesting mathematical models of idealized systems are also discussed. The book provides introductory background material on glassy systems, properties of disordered systems, and transport properties so that it can be understood by researchers in condensed matter physics who are new to this field.

M. POLLAK is Professor Emeritus at the University of California, Riverside. Renowned for his work in this field, he has spent decades researching into electron glass and related subjects.

M. ORTUÑO is a Professor of Physics at the Department of Physics and the Research Institute of Optics and Nanotechnology at the University of Murcia, Spain. He has made important theoretical and computational contributions to the physics of disordered and interacting systems generally and electron glasses particularly.

A. FRYDMAN is a Professor of Physics and heads the nanoelectronic laboratory in Bar Ilan University, Israel. He is an expert in experimental research of the electronic properties of low-dimensional and disordered systems.

The three authors complement themselves in their experience in three active research areas in the field – experiment, theory, and numerical methods.

THE ELECTRON GLASS

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To Rosemarie, Ester, and Margalit

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Contents

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Symbols

A_α	Amplitude of a trajectory
A	Area
$a_{I,J}$	Amplitudes of many-body wavefunctions
$C(t, t_0)$	Correlation function
C	Capacitance
c	Specific heat
D	Difusion constant
D_q	Fractal dimension
d	Dimensionality
E_j	Site energy
$E_{\mathrm{e-e}}$	Electron–electron interaction energy
E_{F}	Fermi level
E_{g}	Width of the Coulomb gap
E_{th}	Thermal energy
E_0	Characteristic energy in $\Omega(E)$
E_{c}	Mobility edge
E_1	Deformation potential
F	Electric field
f	Occupation probability
G	Conductance
g	Dimensionless conductance
$g(r)$	Correlation function
$\mathcal{H}$	Hamiltonian
H	Magnetic field
I	Intensity
I_0	Preexponent of hopping conductivity
J	Spin coupling
j	Current operator

K	Compensation
L	Size of the system
L_{e}	Elastic mean free path
L_{in}	Inelastic mean free path
L_P	Correlation length
L_s	Screening length
L_ϕ	Phase-breaking length
M	Magnetization
$\mathcal{M}$	Matrix element
N	Number of sites
$N(E)$	Density of states
N_0	DOS of noninteracting particles
N_2	Density of excitations
N_e	Number of electrons
$N(\gamma)$	Rate distribution
n	Carrier concentration
n_s	Number of cluster of size s
$n_{i\sigma}$	Occupation number
n_ν	Number of degenerate minima in the electronic spectrum
n_q	Phonon occupation probability
O	Observable
$\mathcal{P}$	Electric power
P_{c}	Critical number
$P(E)$	Number of excitations
P_I	Occupation probability of configuration
p_{c}	Critical probability
q	Phonon wavenumber
q_{EA}	Edward-Anderson order parameter
R	Resistance
$R(t, t_0)$	Response function
$r_{i,j}$	Distance between sites
r_{h}	Hopping distance
r_s	Wigner-Seitz radius
S	Entropy
$S(\omega)$	Power spectrum
S_i	Spin
S_I	Slater determinant
s	Conductivity exponent of hopping conductivity
T_{g}	Glass transition temperature
T_{eff}	Effective temperature

T_0	Characteristic temperature in Efros Shklovskii law
T_1	Characteristic temperature in Mott's law
t	Transfer (hopping) energy
$U_{i,i}$	Hubbard energy
V_g	Gate voltage
$V(\mathbf{r})$	Local potential
$\mathcal{V}$	Volume
V_k	Local pseudo chemical potential
W	Disorder energy
Y	Admittance
y	Preexponential exponent of conductivity
Z	Partition function
z	film thickness
α_d	Factor in characteristic T_1
β	Scaling variable
β_d	Factor in characteristic T_0
χ	Susceptibility
Δ	Energy difference (TLS)
Δ_0	Coupling energy (TLS)
δ	Level spacing
ϵ_3	Activation energy
ε_3	Random site energy
η	Magnitude of the strain tensor
η	Random variable in the hopping exponential
$\phi(r)$	Wavefunction
Γ	Transition rate
γ_2	Electron–electron scattering amplitude
κ	Dielectric constant
μ	Mobility
μ	Chemical potential
ν	Viscosity
ρ	Resistivity
ρ_0	Density of the material
σ	Conductivity
σ	Spin
τ	Mean free time
τ	Relaxation time
$\tau(L)$	Diffusion time
τ_0	Microscopic transition time
Ξ	Deformation potential tensor

ξ	Localization length
$\zeta(x)$	Energy of inserting an electron
ζ	Displacement (due to a phonon)
Ω	Ensemble of microscopic state
$\Omega(E)$	Number of many-electron states
ω	Microscopic state